

Design and development of a Dual-frequency radio beacon for CubeSat missions to measure the Total Electron Content (TEC)

José S. Chávez*¹, Edgardo Pacheco¹, Fernando Villanueva¹

¹ Jicamarca Radio Observatory, Instituto Geofísico del Perú, Ate, Lima, Perú.
(E-mail: jose.chavez@jro.igp.gob.pe, edgardo.pacheco@jro.igp.gob.pe,
fernando.villanueva@jro.igp.gob.pe)

ABSTRACT

Radio beacon transmitters onboard Low Earth Orbit satellites have been widely used to obtain successful ionospheric total electron content (TEC) measurements. Since the invention of its standard, CubeSats have been developing a crescent role in space exploration, mainly for research and educational purposes. However, the use of radio beacon instruments onboard CubeSats involves technical challenges due to the restriction of space and energy. In that manner, the Jicamarca Radio Observatory is developing a radio beacon to be utilized as a CubeSat payload for ionospheric measurements of the Total Electron Content (TEC) and scintillation observations. This instrument would be the first Peruvian satellite payload for research purposes particularly for observing the ionospheric variability.

This paper proposes a design for a dual-frequency phase coherent radio beacon working at 150MHz and 400MHz, with 1.0Watt of emission power for each frequency. We have designed an RF system based on phase locked loop (PLL) components and a control system of the RF signals that will also communicate with the aircraft onboard computer. In this stage of the project, we have built and successfully tested individual circuit boards for each block in the system designed. We will present a description of the system and the results of the initial tests. This instrument will be useful to the ionospheric scientific community due to the capability of measuring TEC increasing the amount and quality of data that can be used by tomographic techniques and models.

Key words: Cubesat, TEC, Scintillation, Beacon satellite, Ionosphere.